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| 10/580,959 | 05/31/2006 | Alexei Trifonov | 061-03US1 | 9222 |

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| EXAMINER | |
|---|---|
| CHEN, SHIN HON | |

| ART UNIT | PAPER NUMBER |
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| 2431 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/580,959 | TRIFONOV ET AL. | |
| | Examiner | Art Unit | |
| | SHIN-HON CHEN | 2431 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 January 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/13/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

1. Claims 1-20 have been examined.

### *Information Disclosure Statement*

2. The information disclosure statement (IDS) submitted on 1/13/09 is being considered by the examiner.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Bonfrate et al. U.S. Pub. No. 20040032954 (hereinafter Bonfrate).

5. As per claim 1, Bonfrate discloses an interferometer system for a one-way QKD system, comprising: a first QKD station that emits a quantum signal and a control signal and having a first interferometer loop (Bonfrate: figure 1: loop 4 on the transmitting side; [0028]: the interferometer on transmitting side); a second QKD station optically coupled to the first QKD station via an optical fiber link and having a second interferometer loop a detection stage operably coupled to an output of the interferometer loop (Bonfrate: [0029]: the receiver receives

signal through optical path and detector shifts phases accordingly), wherein the second interferometer loop has an arm with a phase shifter (Bonfrate: [0039] lines 6-12: phase shifter); a polarization control stage arranged immediately upstream of the second QKD station (Bonfrate: [0017]: depolarizer); a controller coupled to the detection stage and the phase shifter (Bonfrate: [0039]: phase shifter); and wherein the quantum signal and the control signal traverse the same path through the first interferometer loop, the optical fiber link, the polarization control stage and the second interferometer loop, and wherein the control signal is detected by the detection stage and is used by the controller to actively adjust the phase shifter to perform phase-stabilization of the second interferometer loop (Bonfrate: [0039]: lines 9-12: carry out phase shift by the detector on receiver to achieve stabilization).

6. As per claim 2, Bonfrate discloses the system of claim 1. Bonfrate further discloses wherein the control signal and the quantum signal have the same wavelength (Bonfrate: [0030]: having matched length).

7. As per claim 3, Bonfrate discloses the a method of stabilizing a QKD system having a first interferometer loop at a first QKD station and a second interferometer loop at a second QKD station (Bonfrate: figure 1), comprising: sending a control signal and a quantum signal from the first QKD station over the same path of the QKD system to the second QKD station (Bonfrate: [0039]: the pulse pairs sent from transmitter to receiver), including over the first and second interferometer loops (Bonfrate: figure 1: loop 4 on the transmitting side; [0028]: the interferometer on transmitting side); detecting first and second interfered control signals ICS1

and ICS2 at the second QKD station and calculating a ratio ICS1/ISC2 (Bonfrate: [0039] lines 10-12); detecting first and second interfered quantum signals IQS1 and IQS2 at the second QKD station and finding an extremum of a ratio IQS1/IQS2 (Bonfrate: [0039]: interference maximum); and adjusting a phase in an arm of the second interferometer loop based on a value of the ratio ICS1/ICS2 corresponding to the extremum of the ratio IQS1/IQS2 (Bonfrate: [0039] lines 10-11: adjust the phase shift).

8. As per claim 4, Bonfrate discloses the method of claim 3. Bonfrate further discloses wherein the arm of the second interferometer includes a phase shifter driven by a voltage, and including dithering the voltage to maintain the ratio IQS1/IQS2 as constant (Bonfrate: [0031]: same amount of power to maintain the fiber for depolarizer).

9. As per claim 5, Bonfrate discloses the method of claim 3. Bonfrate further discloses wherein the quantum signal and the control signal have the same wavelength (Bonfrate: figure 1: see 10 and 11; [0030]: having matched length).

10. As per claim 6, Bonfrate discloses a method of stabilizing a QKD system, comprising: sending a control signal and a quantum signal from a first QKD station to a second QKD station over the same optical path of an interferometer (Bonfrate: figure 1 and [0028]-[0029]); detecting first and second interfered control signals ICS1 and ICS2 at the second QKD station and calculating a ratio ICS1/ISC2 (Bonfrate: [0039]); determining a value of the ratio ICS1/ICS2 that corresponds to a maximum quantum signal count (Bonfrate: [0039] lines 11-12: interference

maximum); and adjusting a phase of the optical path to maintain said ratio value (Bonfrate: [0039] lines 11-12: result in net phase shift of zero).

11. As per claim 7, Bonfrate discloses the method of claim 6. Bonfrate further discloses wherein adjusting the phase includes providing varying amounts of voltage to a phase shifter in a loop of the interferometer (Bonfrate: [0031]: same amount of power to maintain the fiber for depolarizer).

12. As per claim 8, Bonfrate discloses the method of claim 6. Bonfrate further discloses wherein the maximum quantum signal count is determined by a maximum of a ratio of interfered quantum signals detected at the second QKD station (Bonfrate: [0039] lines 12: the interference maximum).

13. As per claim 9, Bonfrate discloses the method of claim 6. Bonfrate further discloses wherein the quantum signal has a first wavelength, the control signal has a second wavelength (Bonfrate: [0014] lines 5-10; [0030]: having two matched length).

14. As per claim 10, Bonfrate discloses the method of claim 9. Bonfrate further discloses wherein the first and second wavelengths are the same (Bonfrate: figure 1: see 10 and 11; [0030]: two matched length).

15. As per claim 11, Bonfrate discloses a method of stabilizing a QKD system, comprising: sending a control signal and a quantum signal from a first QKD station to a second QKD station over the same optical path of an interferometer (Bonfrate: figure 1 and [0028]-[0029]: transmitting signal over optical path); using the control signal to determine a maximum count of the quantum signal (Bonfrate: [0039] lines 11-12: determine interference maximum); and adjusting a phase of the optical path based on the control signal to maintain the maximum quantum signal count (Bonfrate: figure 1: see 10 and 11; [0039] lines 11-16: adjust the phase shift).

16. As per claim 12, Bonfrate discloses the method of claim 11. Bonfrate further discloses wherein adjusting the phase includes adjusting a voltage of a phase shifter in the optical path (Bonfrate: [0031]: same amount of power to maintain the fiber for depolarizer).

17. As per claim 13, Bonfrate discloses the system of claim 1. Bonfrate further discloses wherein the second interferometer loop is the only interferometer loop in the second QKD station, and wherein the second interferometer loop includes at least one adjustable phase shifter (Bonfrate:[0019]).

18. As per claim 14, Bonfrate discloses the system of claim 13. Bonfrate further discloses wherein the at least one phase shifter provides a stabilizing phase shift in response to stabilization signal (Bonfrate: [0039]).

19. As per claim 15, Bonfrate discloses the system of claim 13. Bonfrate further discloses including dithering the stabilization signal to maintain a maximum set point for the quantum signal (Bonfrate: [0039]).

20. As per claim 16, Bonfrate discloses the system of claim 1. Bonfrate further discloses wherein the polarization control stage includes a polarization scrambler and a polarizing beam splitter (Bonfrate: [0019]).

21. As per claim 17, Bonfrate discloses the system of claim 3. Bonfrate further discloses wherein the second interferometer loop is the only interferometer loop in the second QKD station (Bonfrate: [0019]).

22. As per claim 18, Bonfrate discloses the method of claim 11. Bonfrate further discloses providing at least one phase shifter arranged in an interferometer loop in the second QKD station; and providing a stabilization signal to the at least one phase shifter to adjusting an amount of phase shift in the optical path (Bonfrate: [0047]).

23. As per claim 19, Bonfrate discloses the method of claim 18. Bonfrate further discloses dithering the stabilization signal (Bonfrate: [0019]).

24. As per claim 20, Bonfrate discloses the method of claim 11. Bonfrate further discloses forming the control signal so that the control signal need not be detected by a single-photon detector (Bonfrate: [0020]).

### *Response to Arguments*

25. Applicant's arguments filed 1/13/09 have been fully considered but they are not persuasive.

Regarding applicant's remarks, applicant mainly argues that the prior art of record does not disclose **active** phase modulators or phase shifters and thus cannot be **actively compensated**. However, the claims as rejected do not explicitly disclose whether the steps involved are active or passive and there is no clear argument as to why employing active phase modulator would be patentable over the prior art. Therefore, applicant's argument is traversed.

### *Conclusion*

26. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHIN-HON CHEN whose telephone number is (571)272-3789. The examiner can normally be reached on Monday through Friday 8:30am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (571) 272-3795. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ayaz R. Sheikh/
Supervisory Patent Examiner, Art Unit 2431

Shin-Hon Chen
Examiner
Art Unit 2431

S.C.